PATENT ABSTRACTS OF JAPAN

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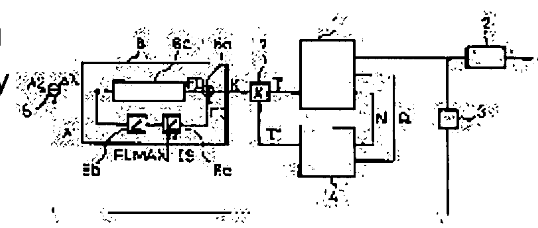
(54) AIR-FUEL RATIO CONTROL DEVICE OF INTERNAL COMBUSTION ENGINE

(57)Abstract:

PURPOSE: To excellently purify the exhaust gas by obtaining correct information of the oxygen amount stored in a three-way catalyst based on the amount of the exhaust gas to flow into the three-way catalyst and the oxygen concentration thereof, and controlling the fuel amount for the intake air amount, and thereby maintaining the amount of the stored oxygen at the specified value.



CONSTITUTION: A three-way catalyst 2 is provided in the exhaust system of an internal combustion engine 1, and at the same time, an oxygen sensor 3 of output-linear type is arranged upstream thereof. The basic fuel injection is determined by a decision device 4 based on the running condition of the internal combustion engine 1. On the other hand, the correction factor is determined by a controller 6 in synchronization therewith. The fuel injection is calculated by a multiplier 7 according to the basic fuel injection and the correction factor. The amount of oxygen stored in the three-way catalyst is calculated by an integrator 6b of the controller 6 based on the amount of the exhaust gas to flow into the three-way catalyst 2 and this content of oxygen. The amount of oxygen is suppressed so as not to be deviated from the allowable of the three-way catalyst 2. In addition, the intake air volume is considered so as to maintain the amount of oxygen at the specified value, and the fuel amount is controlled.

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CLAIMS

[Claim(s)]
[Claim 1] An amount grasp means of oxygen to have a control means to control so that an amount calculation means of oxygen to compute the amount of oxygen stored in the current aforementioned three way component catalyst using the amount of exhaust gas which flows into a three way component catalyst, and its oxygen density, and this amount of oxygen may not separate from the range of the maximum [which said three way component catalyst has], and the minimum oxygen quantity to be stored, The air-fuel ratio control system of the internal combustion engine characterized by providing the fuel quantity control means which controls the fuel quantity which supplies said amount of oxygen grasped by said amount grasp means of oxygen to an engine combustion chamber in consideration of an inhalation air content that it should maintain to the specified quantity.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the air-fuel ratio control system of the internal combustion engine which has a three way catalytic converter in an exhaust air system.
[0002]
[Description of the Prior Art] Generally the catalytic converter for purifying the injurious ingredient in exhaust gas is formed in an internal combustion engine's exhaust air system. The three way catalytic converter is used widely, and this returns nitrogen oxide while oxidizing the carbon monoxide and hydrocarbon which are harmful 3 components in exhaust gas, and it is made to change it into a harmless carbon dioxide, a steam, and nitrogen as this catalytic converter. Depending on the air-fuel ratio of the gaseous mixture by which the purification property by this three way catalytic converter is formed in a combustion chamber, when it is near the theoretical air fuel ratio, it turns out that a three way catalytic converter functions most effectively. This is because an air-fuel ratio is Lean, a reduction operation can become inactive although the oxidation will become active, if there are many amounts of oxygen in exhaust gas, and the oxidation can become inactive although a reduction operation will become active conversely, if an air-fuel ratio is rich and there are few amounts of oxygen in exhaust gas, and fitness cannot be made to purify all of the harmful 3 above-mentioned components. Therefore, an output linear mold oxygen sensor is formed in the flueway, and carrying out feedback control of the gaseous mixture of a combustion chamber to theoretical air fuel ratio using the oxygen density measured by that cause is proposed by the internal combustion engine which has a three way catalytic converter. however, the oxygen density used by this detail letter -- gaseous mixture -- in exhaust gas in case an air-fuel ratio is in a rich condition, it becomes the negative value to which was resembled to that extent and it responded.
[0003] even if it performs such feedback control, in order that inspired air volume may increase rapidly at the time of engine transient operational status, for example, engine acceleration, -- gaseous mixture -- an air-fuel ratio will be in the Lean condition temporarily, and it will be rich conversely at the time of engine moderation. The purification engine performance of exhaust gas is maintainable by using the oxygen which giving the capacity (O2 the storage effectiveness) to store oxygen in a three way component catalyst although the purification engine performance of the exhaust gas of a three way component catalyst will fall at this time if it is usual was proposed, stored excessive oxygen when an air-fuel ratio was in the Lean condition by that cause, and was stored in the rich condition.
[0004] It is [as opposed to / in JP,3-217633,A / engine transient operational status] O2 of a three way component catalyst. In order to use the storage effectiveness effectively When an air-fuel ratio is [Lean or] rich inevitably, an air-fuel ratio is intentionally changed into an opposite condition after that. Air Fuel Ratio Control controlled to make equal the amount of oxygen newly stored in an air-fuel ratio Lean condition and the amount of oxygen used in an air-fuel ratio rich condition that the oxygen stored in a three way component catalyst should be maintained to the specified quantity is proposed.
[0005]
[Problem(s) to be Solved by the Invention] In above-mentioned Air Fuel Ratio Control, the amount of oxygen in which the current three way component catalyst is stored is calculated by carrying out

time quadrature of the oxygen density of exhaust gas. Therefore, since time amount until the oxygen density in the exhaust gas at this time not only becomes quite high, but makes an air-fuel ratio a rich condition intentionally at the time of the engine sudden acceleration to which especially an air-fuel ratio will be in the remarkable Lean condition also becomes long, the calculated value of the amount of oxygen will become very big. This value may exceed the amount of oxygen which can actually be stored in a three way component catalyst, with the conventional technique of this time above-mentioned, an air-fuel ratio rich condition is maintained superfluously, and it is supposed that the amount of oxygen stored in a three way component catalyst has been less than the specified quantity of the condition. It not only cannot grasp correctly the oxygen quantity to be stored of a three way component catalyst after that, but in order to worsen ****** emission at last, an air-fuel ratio will be intentionally made into a rich condition. Moreover, in spite of having used all the oxygen of the specified quantity stored in the three way component catalyst at the time of engine sudden moderation, it will be calculated as oxygen was used further, and an air-fuel ratio will be superfluously maintained in the Lean condition, and the same problem as the above-mentioned is produced also at this time.

[0006] Therefore, the purpose of this invention is offering the air-fuel ratio control system of the internal combustion engine which can grasp correctly the oxygen quantity to be stored of a three way component catalyst, can maintain it to the specified quantity, and can prevent aggravation of exhaust air emission certainly.

[0007]

[Means for Solving the Problem] The air-fuel ratio control system of the internal combustion engine by this invention An amount grasp means of oxygen to have a control means to control so that an amount calculation means of oxygen to compute the amount of oxygen stored in the current aforementioned three way component catalyst using the amount of exhaust gas which flows into a three way component catalyst, and its oxygen density, and this amount of oxygen may not separate from the range of the maximum [which said three way component catalyst has], and the minimum oxygen quantity to be stored, It is characterized by providing the fuel quantity control means which controls the fuel quantity which supplies said amount of oxygen grasped by said amount grasp means of oxygen to an engine combustion chamber in consideration of an inhalation air content that it should maintain to the specified quantity.

[0008]

[Function] The above-mentioned internal combustion engine's air-fuel ratio control system It has a control means to control so that an amount calculation means of oxygen to compute the amount of oxygen in which the amount grasp means of oxygen is stored in the current aforementioned three way component catalyst using the amount of exhaust gas which flows into a three way component catalyst, and its oxygen density, and this amount of oxygen may not separate from the range of the maximum [which said three way component catalyst has], and the minimum oxygen quantity to be stored. The amount of oxygen stored in the three way component catalyst is grasped, and the fuel quantity which a fuel quantity control means supplies to an engine combustion chamber in consideration of an inhalation air content that this amount of oxygen should be maintained to the specified quantity is controlled by this bundle handshaking stage.

[0009]

[Example] Drawing 1 is the block diagram showing the configuration of the air-fuel ratio control system of the internal combustion engine by this invention. In this drawing, the three way component catalyst with which 1 was installed by the internal combustion engine and 2 was installed in the exhaust air system, and 3 are the output linear mold oxygen sensors formed in the three way component catalyst 2 upstream of an exhaust air system. As for a subtractor and 6, the basic fuel-oil-consumption decision machine with which 4 determines the basic fuel oil consumption tau 1 according to engine operational status, and 5 are [a controller and 7] multipliers. The controller 6 is arranged as 6d of joints indicates it in drawing 1 as dynamic characteristics circuit 6a which is the circuit which adjusts dynamic characteristics, i.e., the circuit which makes a closed loop control a high speed, integrator 6b, and integral control machine 6c.

[0010] Thus, a correction factor k is determined according to the 2nd flow chart which a controller 6 shows to drawing 3 synchronizing with it, both are outputted to a multiplier 7, and an internal

combustion engine's constituted air-fuel ratio control system performs fuel injection based on the fuel oil consumption tau calculated there while the basic fuel-oil-consumption decision machine 4 determines the basic fuel oil consumption tau 1 for every predetermined time according to the 1st flow chart shown in drawing 2 .

[0011] The 1st flow chart measures the engine rotational frequency N and inspired air volume Q, and determines the basic fuel oil consumption tau 1 based on these values in step 102 in step 101 using a map etc. with the rotation sensor (not shown) and air flow meter (not shown) which were prepared for the internal combustion engine 1.

[0012] Next, the 2nd flow chart is explained. first -- step 201 -- setting -- an oxygen sensor 3 -- the oxygen density lambda 1 in exhaust gas -- measuring -- step 202 -- setting -- a subtractor 5 -- this oxygen density lambda 1 and theoretical air fuel ratio -- deflection deltalambda with the oxygen density lambda 2 in the exhaust gas of gaseous mixture is computed. This deltalambda will become a forward value if gaseous mixture is in the Lean condition, and if it is in a rich condition, it will become a negative value.

[0013] Next, in step 203, this deltalambda is inputted into integrator 6b of a controller 6, time quadrature is carried out in consideration of the amount E of exhaust gas at this time, and the amount floor line of oxygen stored in the current three way component catalyst 2 is calculated. This amount floor line of oxygen is calculated by adding the product of deltalambda, processing spacing deltat of this flow chart, and the amount E of exhaust gas to the last amount floor line of oxygen in approximation. Although the amount E of exhaust gas may be measured directly, the inspired air volume Q measured in the 1st flow chart can also be used in approximation.

[0014] Next, in step 204, the maximum oxygen quantity to be stored FLMAX of a three way component catalyst 2 is inputted into integral control machine 6c, and it is judged in step 205 whether the amount floor line of oxygen is larger than the maximum oxygen quantity to be stored FLMAX at integral control machine 6c. When this decision is denied, it sets to remain as it is, when affirmed, it sets to step 206, and the amount floor line of oxygen is set to FLMAX, and progresses to step 207. Since it is well-known, how to calculate the maximum oxygen quantity to be stored FLMAX in a three way component catalyst is already omitted.

[0015] In step 207, it is judged whether the amount floor line of oxygen has become less than [which is the minimum oxygen quantity to be stored of a three way component catalyst] zero. When this decision is denied, it sets to remain as it is, when affirmed, it sets to step 208, and the amount floor line of oxygen is set to 0, and progresses to step 209. In step 209, the target oxygen quantity to be stored IS of a three way component catalyst is further inputted into integral control machine 6c, and when, as for the control value FI, only 1 is increased and this decision is denied [in / when it is judged in step 210 whether the amount floor line of oxygen is larger than the target oxygen quantity to be stored IS and this decision is affirmed / step 211], as for the control value FI, only 1 decreases in step 212.

[0016] Next, in step 213, the dynamic-control value FD is computed by being inputted into dynamic characteristics circuit 6a of a controller 6, and above-mentioned deflection deltalambda computes a correction factor k from the control value FI and the dynamic-control value FD by 6d of joints in step 214.

[0017] the gaseous mixture [drawing 4] at the time of engine sudden acceleration -- it is the timing diagram of an air-fuel ratio. according to general Air Fuel Ratio Control -- gaseous mixture -- although an air-fuel ratio is brought close to it gradually, without being less than theoretical air fuel ratio as a continuous line shows, as a dotted line and an alternate long and short dash line show, after an air-fuel ratio is less than theoretical air fuel ratio, according to this example and the above-mentioned conventional technique, it is brought close to it gradually. Drawing 5 is the timing diagram of the calculated value of the oxygen quantity to be stored by this example and the above-mentioned conventional technique at this time. an alternate long and short dash line shows the calculated value in the above-mentioned conventional technique -- as -- the maximum oxygen quantity to be stored of a three way component catalyst 2 -- it may exceed -- that time -- a radical [value / this] -- gaseous mixture, although it changes by count as the amount of oxygen is maintained by the target oxygen quantity to be stored since it changes an air-fuel ratio into a rich condition intentionally Only the part to which the amount of oxygen calculated as an actual oxygen

quantity to be stored was shown in drawing 6 exceeded the maximum oxygen quantity to be stored is less than the target oxygen quantity to be stored.
[0018] Thus, when it separates from an oxygen quantity to be stored with actual calculated value, being unable to grasp correctly the amount of oxygen stored in the three way component catalyst, but changing an air-fuel ratio into a rich condition intentionally after that, may make exhaust air emission only get worse. on the other hand, the calculated value in this example is controlled so that it may not exceed the maximum oxygen quantity to be stored of a three way component catalyst 2, as a dotted line shows -- having -- a radical [value / this] -- gaseous mixture -- since it changes an air-fuel ratio into a rich condition intentionally, the actual amount of oxygen can be maintained at a target oxygen quantity to be stored as calculated value, and such a problem is not produced
[0019] The amount of oxygen always exact since it is controlled so that Air Fuel Ratio Control of this example may not be less than the zero whose calculated value of the amount of oxygen stored at a three way component catalyst 2 is the minimum oxygen quantity to be stored at the time of engine sudden moderation can be grasped, and it is O2 of a three way component catalyst. Aggravation of the exhaust air emission in engine transient operational status can be prevented using the storage effectiveness effectively.
[0020] Moreover, in count of the amount of oxygen stored in a three way component catalyst, the amount of exhaust gas is not taken into consideration, and the above-mentioned conventional technique cannot grasp correctly the amount of oxygen stored in a three way component catalyst by it.
[0021]
[Effect of the Invention] Thus, since the amount of oxygen stored in the present three way component catalyst can be grasped correctly according to the air-fuel ratio control system of the internal combustion engine by this invention When the oxygen quantity to be stored of a three way component catalyst can be maintained to the specified quantity and an air-fuel ratio will be in the Lean condition inevitably by controlling the fuel amount of supply to an inhalation air content, oxygen with an excessive three way component catalyst is stored further. When the exhaust gas at this time can be purified good and it will be in a rich condition, the exhaust gas at this time can be purified good by using the stored oxygen.

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* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the configuration of the air-fuel ratio control system of the internal combustion engine by this invention.
[Drawing 2] It is the 1st flow chart for basic fuel-oil-consumption decision.
[Drawing 3] It is the 2nd flow chart for correction factor decision.
[Drawing 4] It is the timing diagram of the air-fuel ratio at the time of engine sudden acceleration.
[Drawing 5] It is the timing diagram of the calculated value of the oxygen quantity to be stored of the three way component catalyst at the time of engine sudden acceleration.
[Drawing 6] It is the timing diagram of the actual oxygen quantity to be stored of the three way component catalyst by the conventional technique.
[Description of Notations]
1 -- Internal combustion engine
2 -- Three way component catalyst
3 -- Output linear mold oxygen sensor
4 -- Basic fuel-oil-consumption decision machine
5 -- Subtractor
6 -- Controller
7 -- Multiplier

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* NOTICES *

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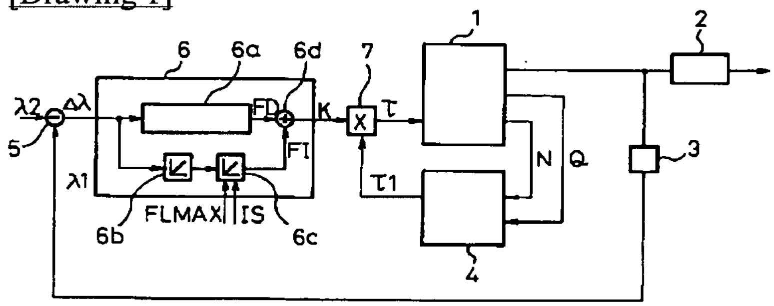
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

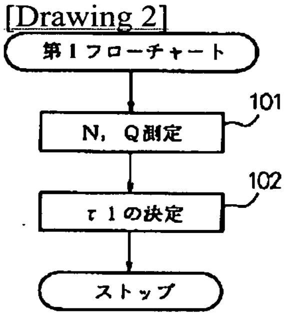
DRAWINGS

[Drawing 1]

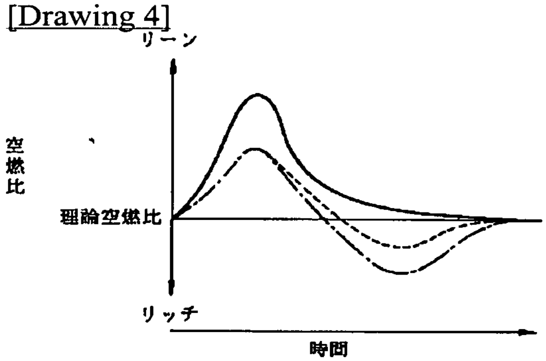


1 …内燃機関
2 …三元触媒
3 …出力リニア型酸素センサ
4 …基本燃料噴射量決定器
5 …減算器
6 …制御器
7 …乗算器

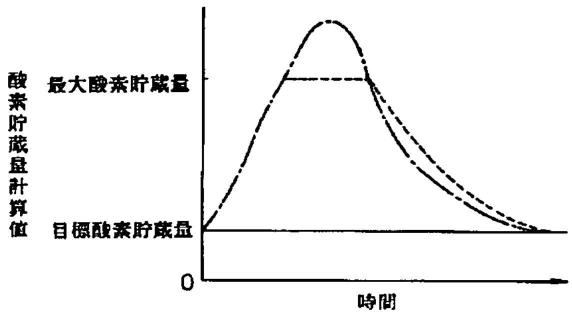
[Drawing 2]



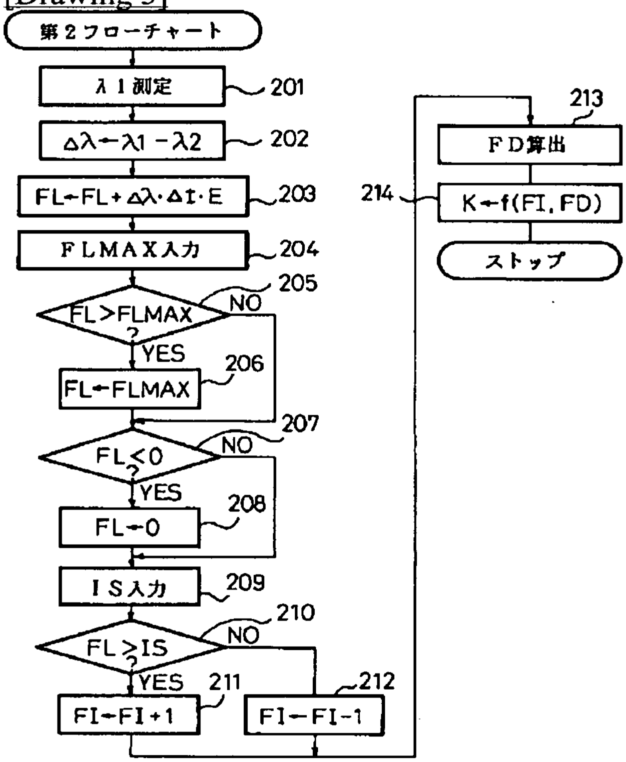
[Drawing 4]



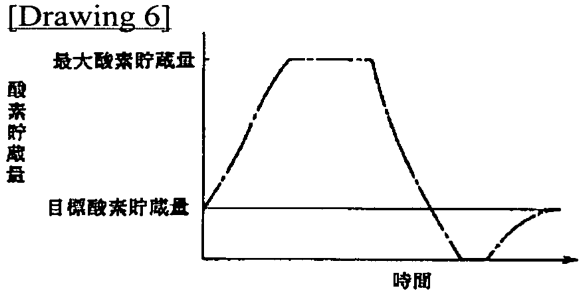
[Drawing 5]



[Drawing 3]



[Drawing 6]



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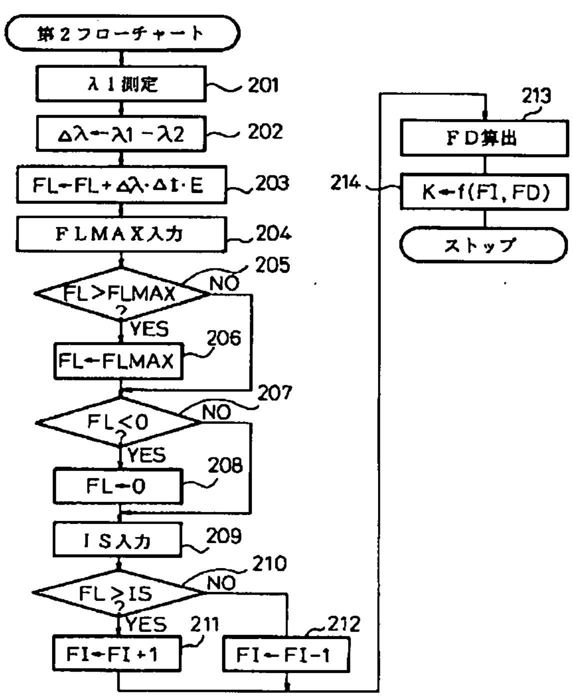
(54)【発明の名称】　内燃機関の空燃比制御装置

(57)【要約】

【目的】　本発明は、三元触媒を有する内燃機関の空燃比制御装置に関し、三元触媒に貯蔵される酸素量を正確に把握してそれを所定量に維持することによって、排気エミッションの悪化を確実に防止することを目的とする。

【構成】　三元触媒に流入する排気ガス量及びその酸素濃度を使用して現在三元触媒に貯蔵されている酸素量を算出する酸素量算出手段（ステップ２０３）及びこの酸素量が三元触媒の有する最大及び最小酸素貯蔵量の範囲から外れないように抑制する抑制手段（ステップ２０５から２０８）を有する酸素量把握手段と、酸素量把握手段により把握された酸素量を所定量に維持すべく吸入空気量を考慮して機関燃焼室に供給する燃料量を制御する燃料量制御手段とを具備する。



【特許請求の範囲】

【請求項１】　三元触媒に流入する排気ガス量及びその酸素濃度を使用して現在前記三元触媒に貯蔵されている酸素量を算出する酸素量算出手段及びこの酸素量が前記三元触媒の有する最大及び最小酸素貯蔵量の範囲から外れないように抑制する抑制手段を有する酸素量把握手段と、前記酸素量把握手段により把握された前記酸素量を所定量に維持すべく吸入空気量を考慮して機関燃焼室に供給する燃料量を制御する燃料量制御手段、とを具備することを特徴とする内燃機関の空燃比制御装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、排気系に三元触媒コンバータを有する内燃機関の空燃比制御装置に関する。

【０００２】

【従来の技術】一般的に内燃機関の排気系には、排気ガス中の有害成分を浄化するための触媒コンバータが設けられている。この触媒コンバータとして、三元触媒コンバータが広く使用されており、これは排気ガス中の有害三成分である一酸化炭素及び炭化水素を酸化すると共に酸化窒素を還元して、無害な二酸化炭素、水蒸気、及び窒素に変換させるものである。この三元触媒コンバータによる浄化特性は、燃焼室内に形成される混合気の空燃比に依存し、それが理論空燃比近傍である時に三元触媒コンバータは最も有効に機能することがわかっている。これは、空燃比がリーンであり排気ガス中の酸素量が多いと、酸化作用が活発となるが還元作用が不活発となり、また空燃比がリッチであり排気ガス中の酸素量が少ないと、逆に還元作用が活発となるが酸化作用が不活発となり、前述の有害三成分を全て良好に浄化させることができないためである。従って、三元触媒コンバータを有する内燃機関には、その排気通路に出力リニア型酸素センサが設けられ、それにより測定される酸素濃度を使用して燃焼室内の混合気を理論空燃比にフィードバック制御することが提案されている。但し、本明細書中で使用する酸素濃度とは、混合気空燃比がリッチ状態の時の排気ガスにおいては、その程度に応じた負の値となるものである。

【０００３】このようなフィードバック制御を実行しても、機関過渡運転状態の時、例えば、機関加速時は吸気量が急増するために混合気空燃比は一時的にリーン状態となり、また機関減速時は逆にリッチ状態となる。この時、通常であれば三元触媒の排気ガスの浄化性能が低下するが、三元触媒に酸素を貯蔵する能力（O_2 ストレージ効果）を持たせることが提案されており、それにより空燃比がリーン状態の時に余分な酸素を貯蔵し、またリッチ状態の時に貯蔵された酸素を使用することにより、排気ガスの浄化性能を維持することができる。

【０００４】特開平３－２１７６３３号公報には、機関過渡運転状態に対して三元触媒のO_2 ストレージ効果を

有効に利用するために、空燃比が必然的にリーン又はリッチ状態となる時に、その後空燃比を意図的に反対の状態にし、三元触媒に貯蔵される酸素を所定量に維持すべく、空燃比リーン状態において新たに貯蔵される酸素量と空燃比リッチ状態において使用される酸素量とを等しくするように制御する空燃比制御が提案されている。

【０００５】

【発明が解決しようとする課題】前述の空燃比制御において、排気ガスの酸素濃度を時間積分することによって現在三元触媒の貯蔵されている酸素量を計算している。従って、特に空燃比がかなりのリーン状態となる機関急加速時において、この時の排気ガス中の酸素濃度がかなり高くなるだけでなく空燃比を意図的にリッチ状態とするまでの時間も長くなるために、酸素量の計算値は非常に大きなものとなる。この値が、実際に三元触媒に貯蔵できる酸素量を越える可能性があり、この時前述の従来技術では、空燃比リッチ状態が過剰に維持され、三元触媒に貯蔵される酸素量が所定量を下回ったままとされる。その後三元触媒の酸素貯蔵量を正確に把握できないだけでなく、遂には排気エミッションを悪化させるために意図的に空燃比をリッチ状態とすることになる。また機関急減速時において、三元触媒に貯蔵されている所定量の酸素が全て使用されたにもかかわらず、さらに酸素を使用したように計算され、過剰に空燃比をリーン状態に維持することになり、この時にも前述と同様な問題を生じる。

【０００６】従って、本発明の目的は、三元触媒の酸素貯蔵量を正確に把握してそれを所定量に維持し、排気エミッションの悪化を確実に防止することができる内燃機関の空燃比制御装置を提供することである。

【０００７】

【課題を解決するための手段】本発明による内燃機関の空燃比制御装置は、三元触媒に流入する排気ガス量及びその酸素濃度を使用して現在前記三元触媒に貯蔵されている酸素量を算出する酸素量算出手段及びこの酸素量が前記三元触媒の有する最大及び最小酸素貯蔵量の範囲から外れないように抑制する抑制手段を有する酸素量把握手段と、前記酸素量把握手段により把握された前記酸素量を所定量に維持すべく吸入空気量を考慮して機関燃焼室に供給する燃料量を制御する燃料量制御手段、とを具備することを特徴とする。

【０００８】

【作用】前述の内燃機関の空燃比制御装置は、酸素量把握手段が三元触媒に流入する排気ガス量及びその酸素濃度を使用して現在前記三元触媒に貯蔵されている酸素量を算出する酸素量算出手段及びこの酸素量が前記三元触媒の有する最大及び最小酸素貯蔵量の範囲から外れないように抑制する抑制手段を有し、この把握手段によって三元触媒に貯蔵されている酸素量を把握し、燃料量制御手段がこの酸素量を所定量に維持すべく吸入空気量を考

慮して機関燃焼室に供給する燃料量を制御する。

【０００９】

【実施例】図１は、本発明による内燃機関の空燃比制御装置の構成を示すブロック図である。同図において、１は内燃機関、２はその排気系に設置された三元触媒、３は排気系の三元触媒２上流に設けられた出力リニア型酸素センサである。４は機関運転状態に応じて基本燃料噴射量τ１を決定する基本燃料噴射量決定器、５は減算器、６は制御器、７は乗算器である。制御器６は、動特性を調整する回路、すなわち閉ループ制御を高速にする回路である動特性回路６ａと、積分器６ｂと、積分制御器６ｃと、結合点６ｄとが図１に示すように配置されている。

【００１０】このように構成された内燃機関の空燃比制御装置は、基本燃料噴射量決定器４が図２に示す第１フローチャートに従って所定時間毎に基本燃料噴射量τ１を決定すると共に、それと同期して制御器６が図３に示す第２フローチャートに従って補正係数ｋを決定し、両者が乗算器７へ出力され、そこで計算された燃料噴射量τを基に燃料噴射を実行するものである。

【００１１】第１フローチャートは、ステップ１０１において、内燃機関１に設けられた回転センサ（図示せず）及びエアフローメータ（図示せず）によって機関回転数Ｎ及び吸気量Ｑを測定し、ステップ１０２において、これらの値を基にマップ等を利用して基本燃料噴射量τ１を決定するものである。

【００１２】次に第２フローチャートを説明する。まずステップ２０１において、酸素センサ３により排気ガス中の酸素濃度λ１を測定し、ステップ２０２において、減算器５によりこの酸素濃度λ１と理論空燃比混合気の排気ガス中の酸素濃度λ２との偏差Δλを算出する。このΔλは混合気がリーン状態であれば正の値となり、リッチ状態であれば負の値となる。

【００１３】次にステップ２０３において、このΔλが制御器６の積分器６ｂへ入力され、この時の排気ガス量Ｅを考慮して時間積分され、現在三元触媒２に貯蔵されている酸素量ＦＬが計算される。この酸素量ＦＬは、近似的に前回の酸素量ＦＬにΔλと本フローチャートの処理間隔Δｔと排気ガス量Ｅとの積を加えることによって計算される。排気ガス量Ｅは、直接測定してもよいが、第１フローチャートにおいて測定された吸気量Ｑを近似的に使用することもできる。

【００１４】次にステップ２０４において、積分制御器６ｃに三元触媒２の最大酸素貯蔵量ＦＬＭＡＸが入力され、ステップ２０５において、積分制御器６ｃで酸素量ＦＬが最大酸素貯蔵量ＦＬＭＡＸより大きいかどうかが判断される。この判断が否定される時はそのまま、また肯定される時はステップ２０６において酸素量ＦＬはＦＬＭＡＸとされ、ステップ２０７に進む。三元触媒における最大酸素貯蔵量ＦＬＭＡＸの求め方は、既に公知となっているために省略する。

【００１５】ステップ２０７において、酸素量ＦＬが、三元触媒の最小酸素貯蔵量である０未満となっているかどうかが判断される。この判断が否定される時はそのまま、また肯定される時はステップ２０８において酸素量ＦＬは０とされ、ステップ２０９に進む。ステップ２０９において、積分制御器６ｃにはさらに三元触媒の目標酸素貯蔵量ＩＳが入力され、ステップ２１０において、酸素量ＦＬが目標酸素貯蔵量ＩＳより大きいかどうかが判断され、この判断が肯定される時、ステップ２１１において制御値ＦＩは１だけ増加され、この判断が否定される時、ステップ２１２において制御値ＦＩは１だけ減少される。

【００１６】次にステップ２１３において、前述の偏差Δλは制御器６の動特性回路６ａに入力されて動的制御値ＦＤが算出され、ステップ２１４において、結合点６ｄで制御値ＦＩと動的制御値ＦＤから補正係数ｋを算出する。

【００１７】図４は、機関急加速時における混合気空燃比のタイムチャートである。一般的な空燃比制御によれば、混合気空燃比は実線で示すように理論空燃比を下回ることなく、それに徐々に近づけられるが、本実施例及び前述の従来技術によれば、空燃比は点線及び一点鎖線で示すように理論空燃比を下回った後、それに徐々に近づけられる。図５は、この時の本実施例及び前述の従来技術による酸素貯蔵量の計算値のタイムチャートである。前述の従来技術における計算値は、一点鎖線で示すように三元触媒２の最大酸素貯蔵量を越える可能性があり、その時にでも、この値を基に混合気空燃比が意図的にリッチ状態にされるために、計算では酸素量が目標酸素貯蔵量に維持されているように成っているが、実際の酸素貯蔵量は、図６に示すように計算された酸素量が最大酸素貯蔵量を越えた分だけ、目標酸素貯蔵量を下回っている。

【００１８】このように計算値が実際の酸素貯蔵量から外れると、その後は、三元触媒に貯蔵されている酸素量を正確に把握することはできず、意図的に空燃比をリッチ状態にすることは、単に排気エミッションを悪化させることになりかねない。一方、本実施例における計算値は、点線で示すように三元触媒２の最大酸素貯蔵量を上回ることがないように抑制され、この値を基に混合気空燃比が意図的にリッチ状態にされるために、実際の酸素量を計算値通りに目標酸素貯蔵量に維持することができ、このような問題を生じることはない。

【００１９】機関急減速時においても、本実施例の空燃比制御は、三元触媒２に貯蔵される酸素量の計算値がその最小酸素貯蔵量であるゼロを下回ることがないように抑制されるために、常に正確な酸素量を把握することができ、三元触媒のO_2ストレージ効果を有効に利用して機関過渡運転状態における排気エミッションの悪化を防

止することができる。

【００２０】また、前述の従来技術は、三元触媒に貯蔵される酸素量の計算において、排気ガス量が考慮されておらず、それによっても三元触媒に貯蔵される酸素量を正確に把握することはできない。

【００２１】

【発明の効果】このように、本発明による内燃機関の空燃比制御装置によれば、現在三元触媒に貯蔵されている酸素量を正確に把握することができるために、吸入空気量に対して燃料供給量を制御することで、三元触媒の酸素貯蔵量を所定量に維持することができ、必然的に空燃比がリーン状態となる時に、三元触媒が余分な酸素をさらに貯蔵して、この時の排気ガスを良好に浄化することができ、またリッチ状態となる時に、貯蔵された酸素を使用することでこの時の排気ガスを良好に浄化することができる。

【図面の簡単な説明】

【図１】本発明による内燃機関の空燃比制御装置の構成を示すブロック図である。＊

＊【図２】基本燃料噴射量決定のための第１フローチャートである。

【図３】補正係数決定のための第２フローチャートである。

【図４】機関急加速時における空燃比のタイムチャートである。

【図５】機関急加速時における三元触媒の酸素貯蔵量の計算値のタイムチャートである。

【図６】従来技術による三元触媒の実際の酸素貯蔵量のタイムチャートである。

【符号の説明】

１…内燃機関

２…三元触媒

３…出力リニア型酸素センサ

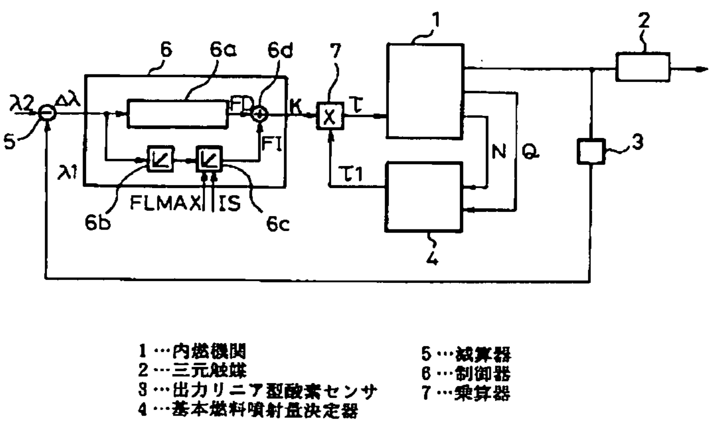
４…基本燃料噴射量決定器

５…減算器

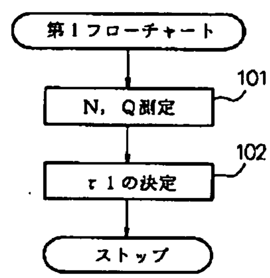
６…制御器

７…乗算器

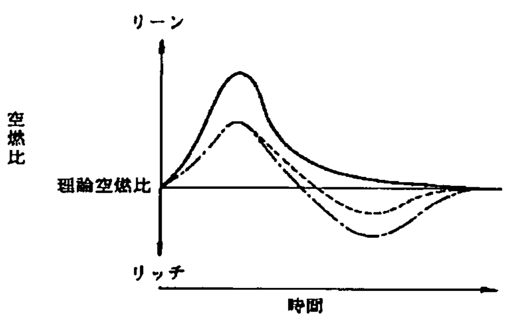
【図１】



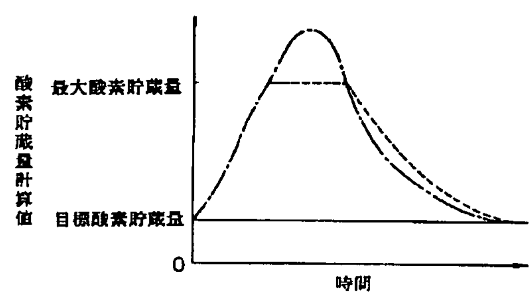
【図２】



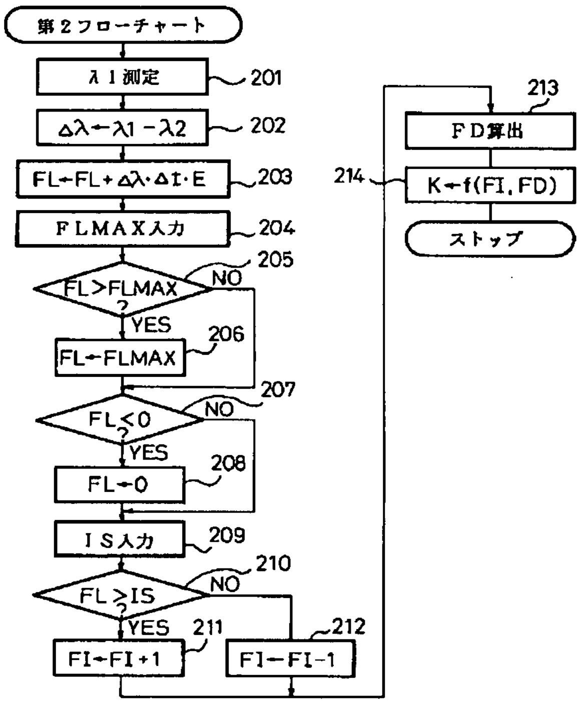
【図４】



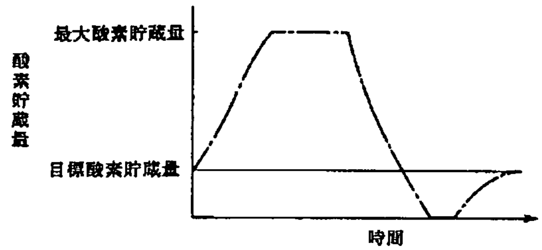
【図５】



【図3】


第2フローチャート
λ1測定
201
Δλ←λ1－λ2
202
FL←FL＋Δλ·ΔI·E
203
FLMAX入力
204
FL>FLMAX?
205
NO
YES
FL←FLMAX
206
FL<0?
207
NO
YES
FL←0
208
IS入力
209
FL≧IS?
210
NO
YES
FI←FI+1
211
FI←FI-1
212
FD算出
213
K←f(FI, FD)
214
ストップ

【図6】


酸素貯蔵量
最大酸素貯蔵量
目標酸素貯蔵量
時間